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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]It is related with the automatic control of an air-conditioner by an electroencephalogram, and automatic stay.

[Description of the Prior Art]JP,5-52382,A in the conditioner using an electroencephalogram. It is. This investigates the amenity of the air conditioning at the time of recovery using an alpha wave. At however, the time of recovery Even if it does not use an electroencephalogram, it dares to be by an ordinary method. Temperature control. Isn't it, if it can do?

[0002]An electroencephalogram is used for U.S. Pat. No. 4949726, and it is one of apparatus. It is it although the structure which turns off is indicated. The electroencephalogram at the time of recovery is used.

This application differs from the meaning.

The delta rhythm is not treated in U.S. Pat. No. 4949726.

[Problem(s) to be Solved by the Invention]Using the remote control of a common type, cooling operation is carried out, and it goes to bed, and is after sleep. Waking up and becoming with some cold by the cold of an air conditioner, for the cooling operation under sleep. It is. This is halfway. It is at a cause to carry out remote control operation of Kula, he half been asleep. Isn't it? This application Control of the conditioner at the time of a user's sleeping which is produced, begins from this experience in shallow sleep, and results in perfect sleep It aims.

[0003]

[Means for Solving the Problem]The microprocessor 4 which controls the conditioner 3 is comprised in response to an EEG analysis means 2 to analyze a theta wave in connection with the electroencephalogram input means 1 and the beginning of sleep in an electroencephalogram, and delta wave in connection with deep sleep, the conditioner 3, and directions of the EEG analysis means 2. Drawing 1.

[Function]When the delta wave which shows the theta wave which shows shallow sleep, and deep sleep is detected, reduce the air capacity of one conditioner and a whizzing sound is reduced by it, or -- the time of 2 cooling operation -- some raising air temperature -- a little -- using warmer temperature and loosening temperature setting similarly at the time of heating operation -- a little -- Colder temperature is used, subsequently the ratio of the delta wave increases, and operation of a conditioner will be turned OFF if it is judged that it was sleeping soundly.

[0005]

[Example]An electroencephalograph can be used as the electroencephalogram input means 1. the EEG analysis means 2 -- the amplifier 6, the band-pass filter 7, and A/D converter 8 -- and -- From the computer 9 or the microprocessor 9 It changes. Drawing 9. Delta wave among electroencephalograms. It appears at the time of sleep, and a 0.5-3.5 Hz. theta wave appears, when beginning to nap.

3.5-7.5 Hz.

The frequency band of this theta wave and the delta wave is future by progress of brain medicine. There is a possibility of changing a little, and there is also individual difference, and it is a few also by age further. I will change. That others have an alpha wave which appears at the time of recovery, and a beta rhythm. It is known. As the microprocessor 4, an ordinary microprocessor inherent in the conditioner 3 may be used, <if it is>. The computer for home automation may be used as the computer 9 of the EEG analysis means 2. As long as the treatment capacity of the computer 9 has remaining power, the microprocessor 4 may be excluded and the computer 9 may be made to execute the control facility by proxy.

[0006]The outstanding advanced technology which unified the electroencephalogram input means 1 and the pioneering EEG analysis means is as HAL<Hemispheric Activation Level Detector>. It is known.

Steve Ciarcia<July 1988 and "BYTE"> -- here, the portion used as the feature of the EEG analysis means 2 of this system is described. The inputted electroencephalogram is carrying out Fast Fourier Transform, and the frequency component is obtained. The frequency distribution is set to B (f). Here f The frequency of an electroencephalogram and B (f) are the intensity of an electroencephalogram, and the amplitude of a brain wave signal. It is the signal strength of a theta wave and the delta wave which integrated the frequency band of a theta wave or the delta wave with this. It carries out based on them and Δ of drawing 2 and θ of drawing 3 are obtained. The denominator of drawing 2 and drawing 3 is an integral value of a brain wave signal about the perimeter wave number ingredient <0.5-30.5 Hz> of an electroencephalogram here. The molecule of drawing 2 is an integral value of the brain wave signal of the delta wave. The molecule of drawing 3 is a brain wave signal integral value of a theta wave. Δ is a ratio which the delta wave occupies in all the ingredients of an

electroencephalogram.

A theta wave thetap in all the ingredients of an electroencephalogram It is a ratio to occupy.

[0007]deltap' of drawing 4 and drawing 5 and thetap' can also be used with deltap and thetap. With drawing 4 and drawing 5 max (delta) It is the maximum of the signal component of the delta wave. max (theta) It is the maximum of the signal component of a theta wave. max (alpha) is the maximum of the signal component of an alpha wave <7.5-13.5 Hz>. max (beta) is the maximum of the signal component of a beta rhythm <13.5-30.5 Hz>. deltap' expresses the ratio of the delta wave of them only paying attention to the maximum of each signal component of the delta wave, a theta wave, an alpha wave, and a beta rhythm -- thetap' -- the same -- The ratio of a theta wave is expressed. As mentioned above, although how [two] the delta wave and a theta wave express the ratio occupied among all the electroencephalogram ingredients were described, In the delta wave or a theta wave, the more suitable formula which expresses the ratio occupied on all the electroencephalograms also except these. If are discovered by progress of brain medicine and it will be difficult to incorporate it as software It will not be. The above-mentioned analysis procedure is software-ized in the EEG analysis means, for example, is calculated by a unit for 1 s.

[0008]sleep begins, it comes out, and a theta wave appears, and deep -- sleeping and coming out -- delta wave although it becomes, if that process is discussed in detail, a 14-Hz spindle wave will appear in this middle time zone, and subsequently the mixture wave of a spindle wave and the delta wave will appear -- soon -- It becomes only the delta wave. Then, the following structure is used for a software top.

1) Error accompanying a 14-Hz electroencephalogram ingredient being disregarded and counting this as a beta rhythm and a recovery wave ingredient as coarse evaluation 0 is used.
2) As fine evaluation, other beta rhythm ingredients cannot be found and it is as a beta rhythm. It is this when there is a 14-Hz electroencephalogram ingredient. As an electroencephalogram at the time of sleep, it includes in a theta wave or the delta wave, and counts. That is, a 2-1 spindle wave is included in a theta wave, a count 2-2 spindle wave is included in the delta wave, and it is 1, 2-1, and 2-2 in a count, i.e., software. It prepares so that either may be made, and the thing suitable for a user's body can be chosen. What is necessary is just to carry out.

[0009]in this way -- thetap, deltap, thetap', and deltap' although computed -- work of the microprocessor 4 for control Here, cooling operation is made into an example and it explains. theta wave others -- a possibility that sleep started when thetap was set to 0.7 as an example, if it became strong as compared with the ingredient of an electroencephalogram It is size. Then, sleep Since the whizzing sound of Kula is reduced so that it may not become obstructive, air capacity is reduced 70%. Similarly, it is thetap. If set to 0.8, air capacity will be reduced 80%. This air capacity. thetap The control reduced proportionally is an example.

For example, $0.5 \times \theta$. It may reduce proportionally.

That is, it is air capacity if θ is set to 0.8. It reduces 40%. Air capacity is the proportionality coefficient, if the one as it is is good and a user will sense. What is necessary is just to use 0.

namely, air capacity the air capacity at the time of $= (1 - \text{proportionality coefficient } 1 \times \theta) \times$ ordinary recovery -- here -- recommended value of the proportionality coefficient 1 0-1.

[0010] If the integrated value of a θ wave and the δ wave becomes strong as compared with other electroencephalogram ingredients and example $\theta + \delta$ will be set to 0.7, it can be said that sleep progressed by middle. Then, air temperature at the time of air conditioning 0.7 degree It raises. That is, it is air temperature Proportionality coefficient 2 $\times (\theta + \delta)$

**** It raises. Recommended value which is the proportionality coefficient 2 here For example, 0-2. Value of the proportionality coefficient 2 It will be 0.7 degree if referred to as 1. It is and, on the other hand, is temperature. As it is A user. When judging, it is to the proportionality coefficient 2. What is necessary is to just be referred to as 0. If the electroencephalogram ingredient of the δ wave becomes strong as compared with other electroencephalogram ingredients It is δ as an example. If set to 0.9, sleep Since it can say that it became deep with *****, Kula may be turned OFF. What is necessary is for the user to use, and just to turn OFF by $\delta > 0.8$, if it senses that this timing is late. On the contrary, what is necessary is just to carry out as [come / by off] by $\delta > 0.95$, if it senses that it is early. Namely, $\theta >$ Coefficient 3 According to the value of the coefficient 3, the timing turned OFF is controllable. Recommended value of the coefficient 3 It is 0.6-0.98.

[0011] The same thing can be performed even if it uses θ' and δ' . Namely, air capacity The air capacity at the time of sleep is controllable by the air capacity at the time of $= x (1 - \text{proportionality coefficient } 4 \times \theta')$ recovery. Recommended value of the proportionality coefficient 4 0-1. the temperature at the time of sleep -- proportionality coefficient 5 $\times (\theta' + \delta')$ only -- small -- Also raise. Today. The recommended values of the proportionality coefficient 5 are 0-2 here. Kula is automatically turned off by the $\delta' >$ coefficient 6. It will be able to do. The recommended values of the coefficient 6 are 0.6-0.98. Drawing 6 is an input screen of these coefficients. It is shown that an underline part is an item which can be inputted. About the conditions which are not used, it is the item which can be inputted. What is necessary is just to make it blank. With these values, the microprocessor 4 or its role slack computer 9 of substitution performs air-conditioner control. The recommended value of the above coefficient 1 - the coefficient 6 is an average example.

A user's body is embraced and it is some. It is set up by the user out of the range. It does not interfere.

[0012] When a timer is set, it goes to bed in 15 minutes - 30 minutes in an ordinary method as it

goes out, but you cannot sleep, it is remote control operation. It must carry out. Such trouble can be abolished in ** and this system. Even after sleep perfect in an ordinary method Occasionally it is tens of minutes or more in 10 minutes about cooling operation. It sometimes continues and this seems to be the cause which catches cold in Kula. However, since Kula is turned OFF, in this system, abolishing this conventional evil simultaneously with a deep sleep It can do. Of course, a similar thing also at the time of heating operation It can do.

[0013]Applying to a stereo this system It can do. That is, the electroencephalogram input means 1, the EEG analysis means 2, the stereo 5 or the tape recorder 5, the minidisc player 5, or the compact disc player 5 is comprised. Drawing 7. Going to bed, hearing a stereo instead of a lullaby. Although it is, when a theta wave and the delta wave are detected, it responds to sleep deepening, corresponding to it. Volume is reduced and it is volume at the time of a deep sleep. 0 is used. for example, -- the time of shallow sleep -- $\text{thetap} \times 0.3 = 0.6$ doubling volume by 0.7 -- $\text{thetap} \times 0.8 = 2 \times 0.4$ time. Namely, volume = coefficient 7 x (1 - thetap) x The above-mentioned volume control is carried out with the volume at the time of recovery, for example, $\text{thetap} > 0.6$. The above is an example of the coefficient 7 = 2.

Recommended value of the coefficient 7 0-2. At the time of sleep of middle, $\text{theta p} + \text{delta p}$ is volume at 0.7, for example. It increases 0.3 time and is volume at $\text{theta p} + \text{delta p} \times 0.8$. It increases 0.2 time. Namely, volume = the above-mentioned volume control is carried out by $\text{theta p} + \text{delta p} > 0.5$ as a volume example at the time of coefficient 8 x x (1 - ($\text{thetap} + \text{deltap}$)) recovery. The recommended value of the coefficient 8 is here at the time of sleep deep to 0 - 1. pan. As an example, it is volume at $\text{deltap} > 0.9$. 0 is used or it is a stereo. It turns OFF. That is, it is volume at the $\text{deltap} >$ coefficient 9. 0 is used or it turns OFF. The recommended values of the coefficient 9 are 0.5-0.99. The same thing can also be performed by thetap' and deltap' . Drawing 8 is an input screen of the parameter of this volume control. An underline part is an item which can be inputted. The conditional expression which is not used is supposing that it is blank, and is with a that and book system. It is discriminable. With drawing 7 The computer 9 of the EEG analysis means 2 is not drawn, and the microprocessor 4 for volume control is because it is made to substitute for the role. Of course, the ordinary microprocessor of immanency in a stereo may be used for volume control <if it is>.

[0014]

[Effect]While a user's sleep deepens, since air capacity is made small, it is lost that the Kula noise becomes **** of sleep and sleep deepens further, and it is air conditioning. Since it loosens and Kula can turn OFF simultaneously with a deep sleep, catching cold is lost by use of Kula. Such control of Kula also becomes saving of electrical charges, and energy saving simultaneously. Since volume will be reduced and a stereo can turn OFF simultaneously with a deep sleep while sleep deepens if this system is applied to a stereo, it ties to more comfortable sleep. Things are made. Optimization of cooling operation control of an air-conditioner and

optimization of the volume control of a stereo are the users itself by the change input of various coefficients. It is made and gets.

[Translation done.]